



**(43) International Publication Date  
11 November 2004 (11.11.2004)**

PCT

(10) International Publication Number  
**WO 2004/098034 A1**

(51) International Patent Classification<sup>7</sup>: H02M 3/155

(21) International Application Number: PCT/JP2004/005756

(22) International Filing Date: 22 April 2004 (22.04.2004)

**(25) Filing Language:** English

(26) Publication Language: English

(30) Priority Data: 2003-123820 28 April 2003 (28.04.2003) JP

(71) *Applicant (for all designated States except US): RICOH COMPANY, LTD. [JP/JP]; 3-6, Nakamagome 1-chome, Ohta-ku, Tokyo 1438555 (JP).*

(72) **Inventors; and**  
(75) **Inventors/Applicants (for US only): NITTA, Shohichi [JP/JP]; 11-5-606, Nishimidorigaoka 3-chome, Toyonaka-shi, Osaka 5600005 (JP). MATSUO, Masahiro [JP/JP]; 6-9, Sakuragaokanishimachi 2-chome, Nishi-ku, Kobe-shi, Hyogo 6512227 (JP). NOMURA, Ritsuko [JP/JP]; 9-35-406, Eirakusou 1-chome, Toyonaka-shi, Osaka 5600051 (JP).**

(74) Agent: ITOH, Tadahiko, 32nd Floor, Yebisu Garden Place Tower, 20-3 Ebisu 4-chome, Shibuya-ku, Tokyo 1506032 (JP).

(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

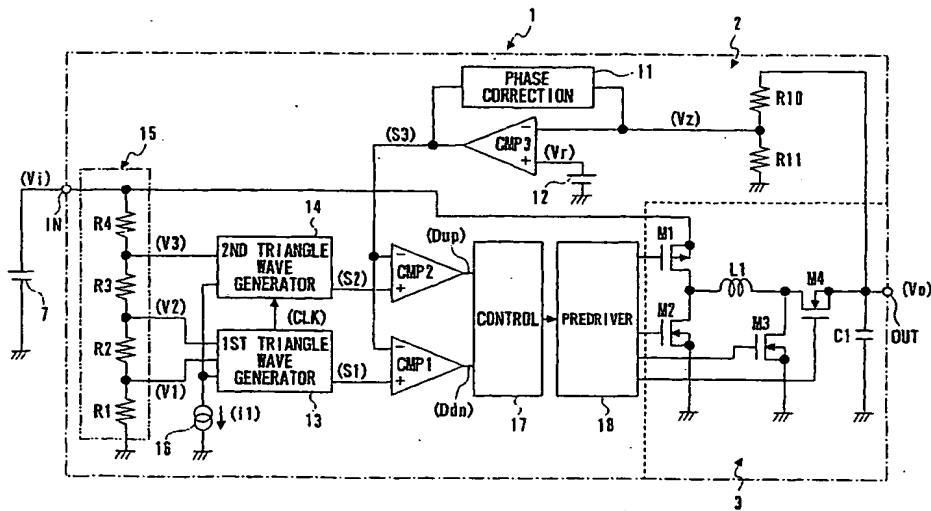
(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— *with international search report*

*[Continued on next page]*

**(54) Title: STEP-UP/DOWN DC-DC CONVERTER**



**(57) Abstract:** A step-up/down DC-DC converter is disclosed that includes: a step-up/down part generating an output voltage by stepping up or down an input voltage; and a control part generating an error signal indicating an error between a voltage value obtained by dividing the output voltage and a predetermined reference voltage, and causing the step-up/down part to perform a step-up or step-down operation based on the comparison between the error signal and first and second triangle wave signals. The control part includes a first circuit generating the first triangle wave signal for step-down control and a second circuit generating the second triangle wave signal for step-up control. The first circuit generates a clock signal synchronized with the first triangle wave signal, and outputs the clock signal to the second circuit. The second circuit generates the second triangle wave signal synchronized with the first triangle wave signal based on the input clock signal.



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*